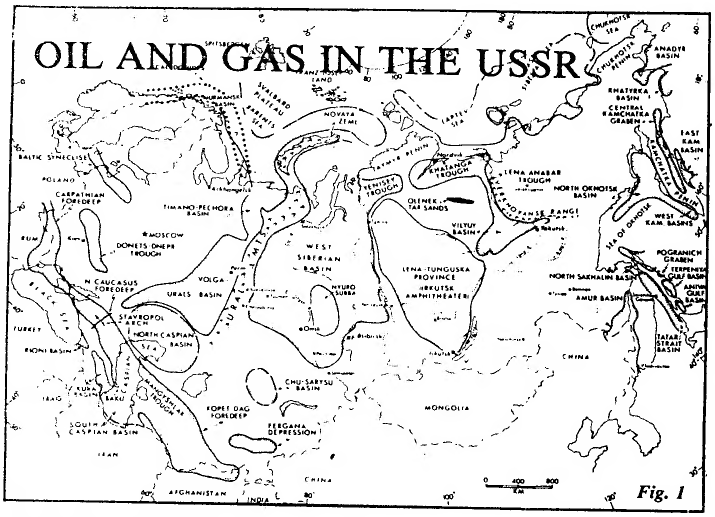


Fig. 1

For the first time since the last world war the Soviets have not been able to increase oil production in order to meet their stringent economic requirements. It is now believed that there is little chance that the Soviets will find further onshore reserves in vast amounts to fill the gap which is required to meet their five-year (plan) production requirements.

The situation has several implications for the Soviets as well as for western countries. The economic implication for the Soviets means that any reduction in oil export levels also means the reduction of "hard currency". And the fact that the Soviets are faced with the situation where there is little hope of making further onshore discoveries means that now there is a significant incentive for offshore activity to commence at a hastened pace. This is necessary if the Soviets are to fill the production gap.

For this exclusive **Noroil** *report,* **Egil Bergsager, deputy director, Norwegian Petroleum Directorate,** *provides some very interesting observations on recent presentations given by the Soviets at the World Geological Congress held in Moscow, about current Soviet oil reserves and what he believes their future implications will be for the USSR as well as for western countries.*

There are two main areas of production from Arctic onshore USSR. Those are the Timan-Pechora and the Western Siberian basins. They are shown in *Fig. 1*. The latter is one of the super provinces of the world.

Discoveries in Western Siberia are shown in *Fig. 2*. The first exploration well was spudded in 1934. The exploration activity was low until 1953 when the first commercial discovery was made. It was a gas field which was found near the town of Berezevo.

That discovery was followed by large-scale exploration activities. More than 200 discoveries have subsequently been made. They include both oil and gas fields. The major oil discoveries have been found in the central part, around 61°–62° N. Samatlor is the largest oil field with recoverable reserves estimated to be almost 3 billion m^3 (60 billion barrels).

The West Siberian basins are perhaps best known for the gas reserves. The major discoveries are made in the northern part towards the Kara Sea. One of them is Urengoy. That was found in Cenomanian sandstone and it is the world's largest gas field. Recoverable reserves are estimated to be more than 6 trillion m^3 (more than 200 TCF). There are several discoveries with estimated reserves of more than 1 trillion m^3 in the area. Reserve figures are always uncertain and those of the Soviets are no exception, but proven gas reserves are estimated to be around 15 trillion m^3 (500 TCF). The ultimate recoverable reserves of the West Siberian onshore areas could be more than 40 trillion m^3 (1400 TCF). Considering the geology and the vast untested areas, I don't feel that it is an unrealistic assumption.

The major discoveries have been made in sandstones from Lower and Middle Cretaceous, but there are also significant discoveries in Jurassic sandstone.

The source rocks are assumed to be organically rich Jurassic shales. Lower Cretaceous shales are possibly also contributing. A generalized lithostratigraphic section is shown in *Fig. 3*. Rich source rocks prevail over most of the area in a mature position. That is a main reason for the anticipation of future discoveries. Soviet geologists attach particular importance to the discovery of oil in horizons deeper than those of the gas discoveries in the northern areas.

Exploration is expected to continue at a very high level in the years to come. Deep horizons and the northern area will probably be the main targets.

The reserves of the Timan-Pechora basin are much lower than those of the Western Siberia. It is, however a significant area of oil and gas production (*see Fig. 4*). The proven reserves are in the order of 450 billion m^3 (3 trillion bbl) of oil. The ultimate potential reserves have been estimated to around 1.5 trillion (10 trillion bbl). The proven gas reserves have been estimated at slightly above 1 trillion m^3 (35 TCF) with ultimate potential of the region to be around 3 trillion m^3 (100 TCF).

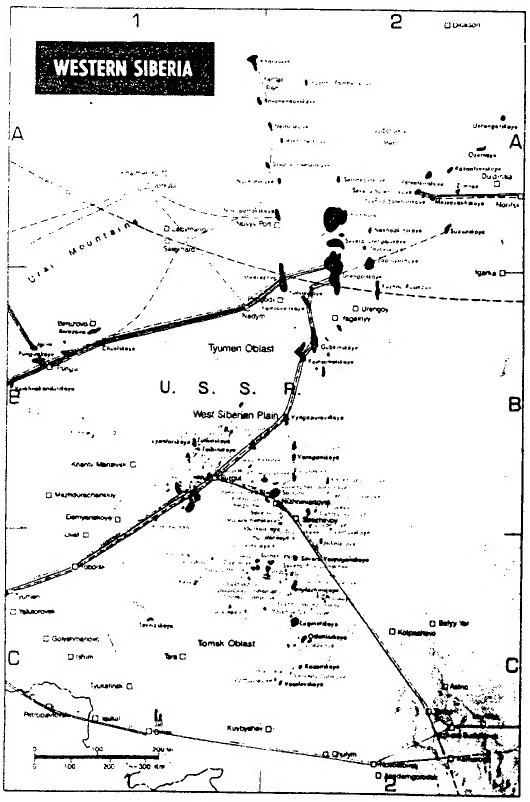
Exploratory drilling in the area commenced as early as the second half of the last century. The first commercial production started in the late thirties.

Production comes from two main horizons. Those are Devonian sandstone and Permian limestone. The source rock is assumed to be Upper and possibly Middle Devonian organically rich shales. Potential source rocks have also been reported from beds as old as Ordovician. A generalised lithostratigraphic section is shown in Fig. 5.

Exploration activity is expected to continue at the moderate level of today. High priority is expected to be given to the northern areas and their geologic continuation into the Pechora Sea.

The eastern Soviet Arctic includes large areas sometimes called Eastern Siberian basins. They are little known. Exploration drilling has been performed, but is at a very premature

Fig. 2



OIL AND GAS FIELDS

stage. Some Soviet geologists have publicly said they believe the Eastern Siberian basins could contain oil and gas reserves in the same order as that of Western Siberian basins. At this stage I consider such statements as "guestimates" rather than estimates.

Offshore

The continental shelf of the Soviet Arctic is the largest in the world. It includes the eastern part of the Barents Sea, the Kara Sea, the Laptev Sea, the East Siberian Sea and the western part of the Chukhotsk Sea.

Up till a few years ago the Soviets didn't have technology for offshore exploration except for the shallow parts of the Caspian Sea. It is only during the last decade they have acquired seismic vessels capable of doing deep, multifold reflection seismic. They have also acquired drilling units. Since 1980 they have bought three large drillships with dynamic positioning systems. The ships are built at Rauma Repola shipyard in Finland and they are designed to be particularly well suited for Arctic areas. They are probably the world's most advanced drilling units for Arctic offshore areas.

Extensive seismic surveys have occurred in the Barents Sea since 1978. The main interest has been concentrated on the area between Novaya Zemlya and the Kola Peninsula. Some profiles have also been acquired in the Kara Sea.

The first well on the Soviet Arctic Continental Shelf in the north was spudded in late spring of 1982 by *Valentin Shashin*, the first of the three drillships delivered from Finland. The location was around 70° N and 42° E. Geologically it is located on a large structure called Murmansk High.

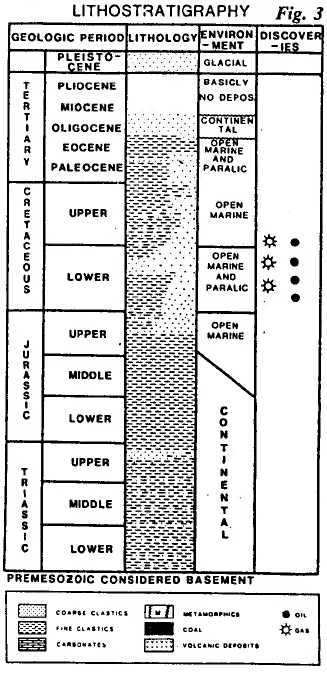
The first drilling season was not a very successful one. Only one ship was used. They had problems managing the new technology and they penetrated only the upper part of the section. It could perhaps be said that the Soviets experienced that it is one thing to buy advanced technology, but it is another to manage it, especially if they insist on doing it all by themselves.

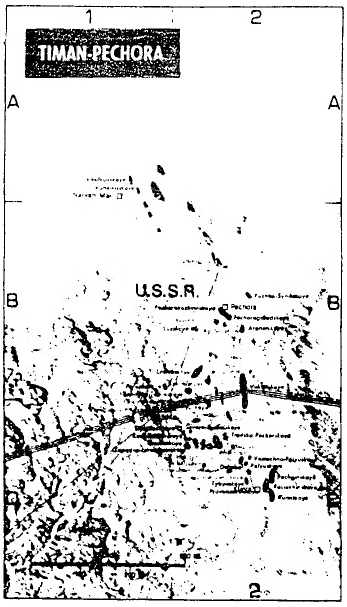
The Soviets are, however, in a learning curve. Last year they used two of the drillships in the Barents Sea. They have finished the well they spudded the year before, and spudded another one only a short distance from the first.

A third well was spudded further to the west. That well caused some discussion in Norway since it is close to the border of the disputed area. The median line adjacent to the land areas of USSR and Norway constitutes the eastern border of the disputed area. It has never been accurately established and there is an uncertainty of several nautical miles in an east-west direction. The well can therefore not be said to be located in "undisputed disputed area".

Geologically it is located on a salt-induced structure in what is called the Varanger Basin. Wells have also been spudded in the Pechora Sea, immediately of the mouth of the Pechora

WESTERN SIBERIA – GENERALIZED LITHOSTRATIGRAPHY *Fig. 3*





OIL AND GAS FIELDS *Fig. 4*

river. This is in very shallow water.

The Soviets have announced that they will expand towards the northeast and into the Kara Sea during the next years.

Drilling has also commenced in the Sea of Okotsk. This has been done in cooperation with Japanese oil companies. Discoveries of oil and gas have been reported. The full significance of them is not known, but they are planning for future production from the area.

The whole of the Soviet Arctic Continental Shelf is considered prospective from a geological point of view, but the knowledge of the area is at a very premature stage. Except for the limited areas where seismic has been acquired and drilling has commenced, the details of the geology of the Soviet Arctic Continental Shelf is basically unknown.

Based on the knowledge of the onshore geology, the most prospective area might be the Kara Sea. This is where the Western Siberian basin is expected to continue towards the north. The most negative aspect seen from a USSR point of view is that gas may be dominating like the adjacent onshore areas. Since gas has been found onshore in huge quantities, it is more important to find oil. The Barents Sea and the Sea of Okotsk are therefore logical places to start offshore exploration seen from a geological point of view. The ice challenge of the Kara Sea is also much greater than that of the Barents Sea.

It should be mentioned that geological theories which imply that the Kara Sea may be a major oil province have been proposed and argued for in an able manner.

Technological challenges

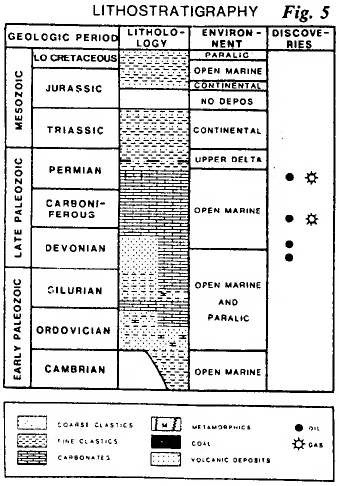
The ice represents the major technological challenge. Significant portions of the shelf are covered by more or less permanent ice as shown in *Fig. 2*.

This will make exploration drilling very expensive. Possible production will likewise be very costly compared to that of less hostile areas.

When technological challenges in the USSR are discussed it is necessary to make a mention of the massive bureaucracy that exists. This creates a handicap to technological progress. Such problems become more apparent within fields of high technology like offshore exploration and exploitation in Arctic areas.

Very significant parts of the Soviet Arctic are considered sensitive from a military security point of view. This implies that the selection of people will be based on security considerations before technical ability. Cooperation with other industrialised countries will be minimised. So will contact at technical levels with experts from other countries. Those factors will probably represent a very major obstacle to the rapid progress of offshore technology in the USSR.

TIMAN - PECHORA GENERALIZED LITHOSTRATIGRAPHY *Fig. 5*



The Soviets will, of course, be able to meet advanced technical challenges like launching space ships, constructing specialised submarines or developing certain offshore installations. It requires priority from Moscow and the necessary resources. Progress on a broad scale within high areas of technology like offshore Arctic petroleum activities, however, will to a great extent be hindered by the political system.

The offshore industry is international in nature and I believe that any political system which excludes itself from contact and cooperation on a broad scale is bound to be behind. Advanced technology can be bought, but it is necessary to observe that it is dynamic. Progress will always be made and the countries that take the fullest advantage of such progress will be those which have an open society and allow for broad international contacts and cooperation. One could therefore say that the biggest challenge for USSR when it comes to technological progress is to adjust certain aspects of its political system.

USSR – Production of oil and gas

Exploration in Arctic areas has to be seen in the relation to total hydrocarbon production in the USSR. *Fig 6* shows the annual oil production since 1972. Three quarters of present production comes from the Western Siberian basins in the Arctic. The USSR is by far the largest oil producer in the world. It has increased production every year. Export of oil to western countries represents the main source of "hard" currency for the USSR.

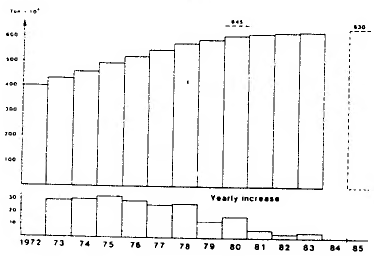
This situation might appear bright, but there are two very negative aspects seen from a Soviet point of view:

– The annual increase in production has fallen considerably as shown in *Fig 6.*

– Although large, the annual production is less than the expectations of the five-year plan.

This production trend has been even more marked this year. The production of oil during the first six months of 1984 was 307 billion tonnes. This is less than that of the similar period in 1983. According to Soviet statistics it is 99.9%, but when considering that 1984 is a leap year the correct figure will be 99.3%. This is the first time since the world war that production figures are

Fig. 6



Annual Oil Production in the USSR.

lower than those for the previous year.

At the World Geological Congress in Moscow this month it was stated in papers given by prominent Soviet geologists that, "with the exception of East Siberia, all of the major sedimentary basins onshore the USSR have been explored to such an extent that we have a reasonably good idea about the amounts of oil and gas which can be found. Several small and medium-sized fields will be found, but all of the giant fields in the known prospective levels have probably been already discovered."

The geological conditions of the East Siberian areas as we know them today do not favour giant accummulations of oil. Even if giant accummulations should be discovered, the logistics of this very remote area will prevent any significant contribution to production for many years.

The geological message at the Congress was that the USSR would give priority to exploration aimed at stratagriphic traps and very deep prospects. When translated into production language, these elements imply that the USSR will probably not be able to fulfill its production plans.

The prognosis for the present five-year plan is 630 million tonnes in 1985. I don't believe the Soviets will be able to achieve this level. In fact, I believe they will be faced with considerable problems trying to maintain the present level of 617 million tonnes. The USSR might be able to raise the level somewhat, but only for a short period.

The development which we have seen over the last couple of years agrees with my earlier assumptions during late 1981, which were published in *Noroil, January 1982*. At that time I indicated: "I believe the USSR will be able to increase annual production, but it may have problems achieving the goal set for its five-year plan. A more probable prognosis would be 620 million tonnes." Recent developments indicate that the Soviets might have problems achieving the level of 620 million tonnes.

All Soviet oil production comes from the onshore areas and it was only a few years ago that offshore exploration commenced in the USSR. It is comprised of vast Arctic areas which could contain very significant amounts of oil. Although high priority has been given to offshore exploration, no significant contribution to production can be expected before the turn of the century.

Distance to market, ice and technological challenges would necessitate at least a decade to delineate and develop such fields even with the most efficient operations. With the inefficiency which seems to be built-in to the Soviet system one would have to add additional years.

It should be recognised, though, that if a major discovery were made offshore the USSR in the Barents Sea, it would have wide political, technological and economic implications for western countries as well as for the USSR.

The political implications are important. The export of oil is the most important source of "hard" currency in the USSR and because it needs such currency it has continued to raise its exports to "hard currency" countries.

Import from USSR is the main source of oil to the Eastern European countries and other Communist countries like Vietnam and Cuba. Such oil was sold at a low price, thereby securing political influence. In previous years Soviet production was more than sufficient to accommodate those aims in addition to a steady increase of i ternal consumption. This is not t case any more. It has been necessa to cut down export to Commun countries and the USSR is forced save energy at home.

To compensate for lower domest production the USSR has bought i creasing amounts of oil from Midd East countries, like Libya. This h partly been paid for through the supp of weapons. The method of payme and the USSR's increasing vested i terest in the Middle East drives hon the political implications of Sovi problems in fulfilling production plan Understanding the trends in Soviet c production is probably an importa element in the analysis of Soviet polic beyond the energy question as such.

Soviet gas production shows a diff rent pattern. The annual increase i production remains at a high level an has met the production targets of th five-year plan. One reason for this the enormous gas discoveries aroun Yamal peninsula in the very norther part of the West Siberian basins.

More than half of the USSR gas pro duction comes from this area. The ga discoveries place USSR in a positio where it can sell as much as Europe o other buyers are willing to take. Th sale of gas is therefore becoming a important source for income of hard currency.

I don't believe the USSR will sell gas at dumping prices. With its need fo hard currency and the high costs involved in the development of the discoveries in the remote Arctic areas, it will probably seek as high prices as possible. The need for hard currency, however, implies that such currency has an economic value in itself for the USSR. This is an element in the negotiations of gas sales which is difficult to evaluate.

Fig. 7